(10.3%) were attributed to bacterial infection. Risk factors associated with higher risk of bacterial infections included age < 2 years at transplantation (p=0.001), use of PB (p=0.038), myeloablative conditioning (p=0.027), mismatched or unrelated donor (p= 0.002), family donors other than identical siblings (p=0.046), use of TPN (p=0.046), and morphine use for more than 5 days (p=0.011) due to significant mucositis. In a multivariate analysis; age at transplantation < 2 years (HR=6.834; 95% CI 1.528-30.572; p=0.0119) was the only factor associated with higher risk for bacterial infection post HSCT.

Conclusion: Bacterial infections are common following allogeneic HSCT in children and adolescents not receiving antibiotic prophylaxis and are associated with significant risk of mortality. Children below 2 years of age are at higher risk. We have prospectively implemented an antibiotic prophylaxis regimen in an effort to decrease bacterial infections.

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Incidence of CMV Reactivation and Infection in Children and Adolescents Following Allogeneic Hematopoietic Stem Cell Transplantation in High CMV Exposure Population

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Introduction: Cytomegalovirus (CMV) infection is a known complication following allogeneic hematopoietic stem cell transplantation (HSCT). The method and duration of CMV monitoring are center-dependent, and no standards on the effective duration of CMV surveillance are clearly reported in the literature especially in areas with high CMV exposure.

Patients and Methods: We retrospectively reviewed the medical records of all consecutive patients who received allogeneic HSCT between January 2008 and April 2014 at King Hussein Cancer Center (KHCC) in Jordan. The CMV infection was monitored using pp65 antigenemia test weekly from time of neutrophil engraftment until day 100 post transplantation. Treatment with gancyclovir was initiated when two consecutive positive antigenemia tests of more than two cells per 250 WBC were documented. All patients received leukofiltered and irradiated blood products.

Results: A total of 200 patients were identified, with median age of 9 year (2 months-27 year). Sixty percent (n=119) were males. One hundred and nineteen patients (60%) had non-malignant diseases. Peripheral blood (PB) was the stem cell source in 110 (55%), 69 (34.5%) received bone marrow and 21 patients (10.5%) received cord blood. Sixty nine percent received myeloablative conditioning (n=137), 26% reduced intensity (n=52) and 5% no conditioning regimen (n=11). Ninety-one percent (n=182) were matched-related (140 were HLA identical siblings and 42 were other family donors). Ninety three percent of our patients (n=186) and 83% of donors (n=166) were CMV sero positive. Thirty-five patients (17.5%) needed preemptive therapy for CMV reactivation at a median of 33 days (14-70) following transplantation. The median number of cells was one cell per 250 WBC (1-2298). Ten patients continued to have positive CMV antigenemia on day 70, and 3 on day 100, while only one patient had new episode of CMV reactivation after 70 days post transplantation. Two patients (1%) developed CMV disease (pneumonitis and colitis). In univariate analysis, patients who received ATG (p=0.005), non-sibling related donors (p=0.037), mismatched or unrelated donor transplants (p=0.007), PB (p=0.019), and myeloablative conditioning (p=0.004) were at higher risk for developing CMV reactivation. In multivariate analysis; ATG use (HR=2.87; 95% CI 1.026-8.025; p=0.0445) and the use of mismatched related or unrelated donor (HR=11.11; 95% CI 1.87-66.67, p=0.0081) was associated with increased risk of CMV reactivation.

Conclusion: The incidence of CMV reactivation following allogeneic HSCT in children and adolescents within high CMV exposure population is low. Shortening the duration of CMV surveillance may be feasible. Use of ATG in the preparative regimen and those receiving mismatched or alternative donor transplants are at the highest risk for CMV reactivation.

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Predictors and Outcomes of Intensive Care Utilization in Patients Undergoing Allogeneic Hematopoietic Stem Cell Transplant at Mayo Clinic, Florida

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To understand predictors and outcomes of ICU admission we conducted a retrospective study of consecutive patients undergoing allogeneic HCT over a 10 year period 1/2002 - 12/2012. Information about patient demographics, disease characteristics, disease status, co-morbidities, conditioning regimen, donor characteristics and ICU interventions were collected. Single and multivariable analysis was used to assess associations between various characteristics and outcomes. Survival probabilities were estimated using the Kaplan-Meier method.

118 patients underwent first transplant. Median age was 51 (range 20-72); 81% had leukemia. 39 (33%) patients were admitted to the ICU within the first 100 days; 22 within 14 days of transplant. Median survival of these patients was 54 days (95% CI 14-189) compared to 4.5 years for patients not admitted to ICU. In single variable analysis, TBI (p=0.04), URD (p=0.03), mismatched donor (p=0.009)*, and not in CR (p<0.001)* were associated with increased likelihood of ICU admission (*significance in multivariable analysis). HCT-CI score was not found to be associated with ICU admission.

Increased risk of death in ICU patients was associated with male sex (p<0.001), HCT-CI defined liver dysfunction (p=0.003) and vasopressor administration (p=0.020) in single variable analysis. Adjusting for sex (HR=4.63), vasopressor administration (HR 4.54, p=0.001) and number of ICU interventions within 48 hours of admission (HR 3.48 [>1 vs 0], p= 0.026) were associated with increased risk of death. APACHE score was not associated.

Compared to females, male patients had higher rates of myeloablative regimens (71% v 56%), TBI (48% v 33%), URD HCT (76% v 44%) and vasopressor use (33% v 24%) as well as lower rates of CR (19% v 28%) at time of transplant.

ICU admission was associated with an increased risk of death (HR = 3.70, 95% CI 2.26-6.06, p <0.001). ICU survivors tended to have worse long-term outcomes. Among 18 patients alive at day 90, 12 survived to one year (67%) compared to 61 out of 79 (77%) who never required ICU admission (p=0.84). Further analysis to understand the causes of worse outcomes

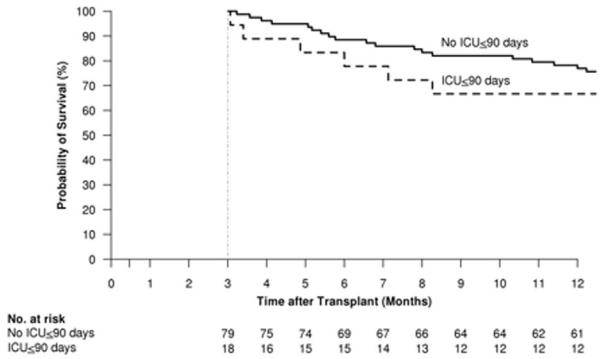

Figure 1. Survival among patients alive at 90 days after transplant according to whether they were admitted to the ICU within 90 days after transplant.

in males is ongoing. Poorer long-term outcomes in ICU survivors warrant validation in a larger cohort and further research to understand its mechanism and develop appropriate strategies. Our study is limited by type II and type I errors due to small sample size and multiple variables. Nonetheless, these results provide potentially important data for patient counseling and may help guide management of critical illness post-transplant.

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Implementation of Chemotherapy Order and Administration Checklists Ensures Adherence to National Chemotherapy Guidelines

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Background: In 2011, the American Society of Clinical Oncology (ASCO) and the Oncology Nursing Society (ONS) expanded the scope of their 2009 guidelines to address chemotherapy administration safety in the inpatient setting (Jacobson, J., Polovich, M., et al., 2012). The guidelines encompass physician, pharmacy and nursing practices surrounding chemotherapy ordering, processing and delivery. A review of our current processes elucidated opportunity for improvement.

Objectives: To develop and implement processes promoting multidisciplinary congruency with the ASCO/ONS guidelines across our BMT, Hematology and Oncology Inpatient and Ambulatory Care units.

To safeguard administration of chemotherapy.

Interventions: Our initial step involved updating our chemotherapy administration policy for pharmacy and nursing to include recommendations from ONS/ASCO. The policy underwent multiple revisions by nursing, pharmacy and the medical staff prior to approval in July, 2013. Once approved, we developed a checklist for both pharmacy and nursing use to help ensure all required elements were addressed in the order sets prior to processing a chemotherapy order. A separate checklist was created for RN use before and after chemotherapy administration. Finally, we revised the chemotherapy order template for physicians to use in the absence of a pre-printed order set. RN staff, oncology pharmacists and the oncologists were in-serviced on the new policy, order sets and checklists. Beginning in September, 2013, audits were performed on all returned checklists.

Evaluation: In the first months following implementation of the policy, compliance with completion of the checklists was less than 50%. RN champions agreed to audit 100% of the chemotherapy doses ordered and administered. Pharmacy and Nursing compared their orders for the month to ensure there were no missing checklists. Compliance data was shared with the staff on the Oncology/Blood Cancer/BMT Units and individual performance deficits were addressed. Audits of all orders and checklists were continued until greater than 90% compliance was reached. Audits are now done quarterly to monitor continued compliance.

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Rates of Infection and Pathogen Detection for Patients Undergoing Hematopoietic Stem Cell Transplantation (HSCT)

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With changing immunomodulation, prophylactic and empiric therapy in HSCT patients, continual reassessment of infecting pathogens and rates of recovery are required as infections remain a leading cause of morbidity and mortality. We performed a retrospective chart review of 86 BMT patients who underwent allogeneic HSCT (AlloSCT) or autologous HSCT (ASCT) from 7/11 to 4/14 and with 100 days of post-transplant follow-up. Evaluation included pathogen detection and recovery from D0-30 and D31-100 (defined as one set of testing per 24h period).

There were 86 patients, 30 AlloSCT (median age 35, 20-66) and 56 ASCT (median age 55, 20-72). Age and gender had no statistically significant effect on overall mortality. 100% of patients underwent evaluations for infection. Of 406 total samples obtained, only 22 (5%) revealed a pathogen. 158 (119 D0-30, 39 D31-100) blood culture evaluations were obtained in 66 patients (50 D0-30, 16 D31-100) with only 10 (5 D0-30, 5 D31-100) positive evaluations in 8 patients. Overall, 11% of ASCT and 14% of AlloSCT patients had clinically significant bacteremia. 96 (71 D0-30, 25 D31-100) urine cultures were obtained in 55 patients with 3 (0 D0-30, 3 D31-100) positive evaluations in 2 patients resulting in 0% of ASCT and 7% of AlloSCT with clinically significant bacteriuria. 152 (130 D0-30, 22 D31-100) *C. diff* tests were obtained in 77 patients with 9 positive evaluations in 8 patients (6 D0-30, 2 D31-100) resulting in a *C. diff* detection rate of 12% and 11% in ASCT and AlloSCT patients, respectively. All-cause mortality was 14% (7% ASCT, 27% AlloSCT; $p = 0.021$). Of patients with positive blood, urine, and *C.diff* testing, mortality was 50% ($p = 0.020$), 100% ($p = 0.042$), and 25% (0.003), respectively. No patients died during D0-D100. After D100, infection-related mortality was 25%.

Actionable infections require rapid detection in BMT patients. Clinical parameters often trigger extensive evaluations but our diagnostic yield was $< 15\%$. Infections during D0-D100 were associated with greater all-cause mortality and 25% of post-transplant death was attributed to infection. While current empiric therapy has reduced infection rates, improved clinical algorithms and methods of pathogen detection are needed to improve HSCT care.